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Feldeisen et al.

[11] **4,060,105**

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[54] TONER LOADING APPARATUS WITH REPLENISHING SUPPLY CONTAINER

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[73] Assignee: **Xerox Corporation,** Stamford, Conn.

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[22] Filed: **Oct. 22, 1976**

Related U.S. Application Data

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[51] **Int. Cl.**[2] **B65B 1/06**

[52] **U.S. Cl.** **141/1;** 141/363; 222/325; 222/DIG. 1

[58] **Field of Search** 141/363–366, 141/1; 222/DIG. 1, 325, 386.5, 215, 206

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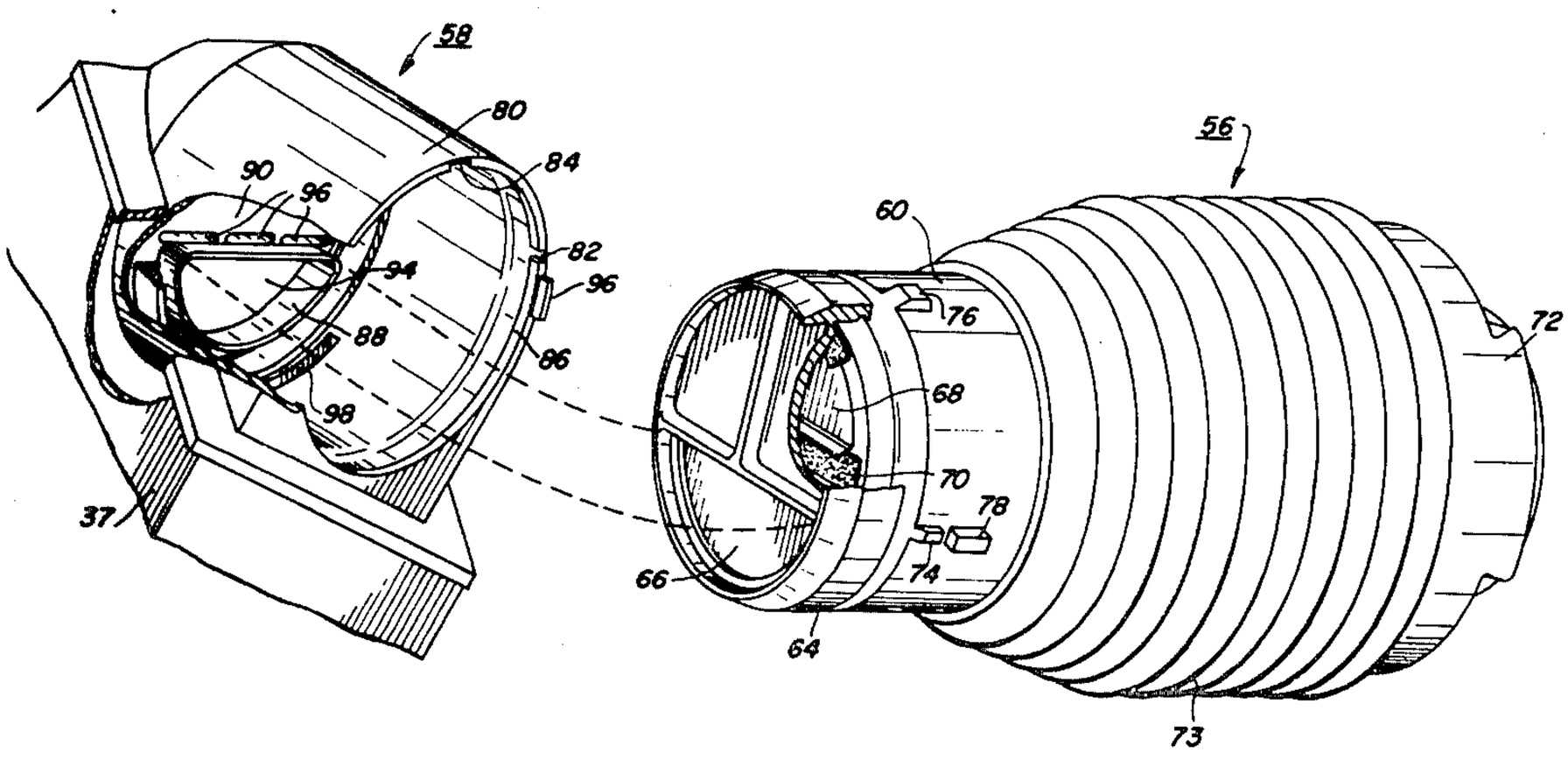
[57] **ABSTRACT**

To add toner to the toner hopper of an electrostatic reproduction machine without contaminating either the operator or the interior of the machine, an improved toner bottle and receiver coact so as to eliminate or minimize the danger of generating toner clouds or spilling toner during the loading operation. The bottle has a body and a cap rotatably mounted on one end of the body. The body has a plurality of locating and locking lugs which coact with corresponding channels in the receiver so that the bottle can be inserted into the receiver in only one position. When a closed toner bottle is inserted into the receiver, a lip serves both to position the cap relative to an inlet opening of the receiver, and to retain the cap in this position as the body is rotated so that openings in the body and cap are aligned with the inlet opening; a suitable mechanism stops the body when the three openings are aligned. As the body is rotated, the bottle is simultaneously locked onto the hopper by the lugs being moved out of alignment with their corresponding channels. After being locked onto the hopper a bellows portion of the body is compressed to expel toner into the hopper. In order to remove the bottle from the hopper, it must be returned to its initial position which also closes the bottle.

5 Claims, 5 Drawing Figures



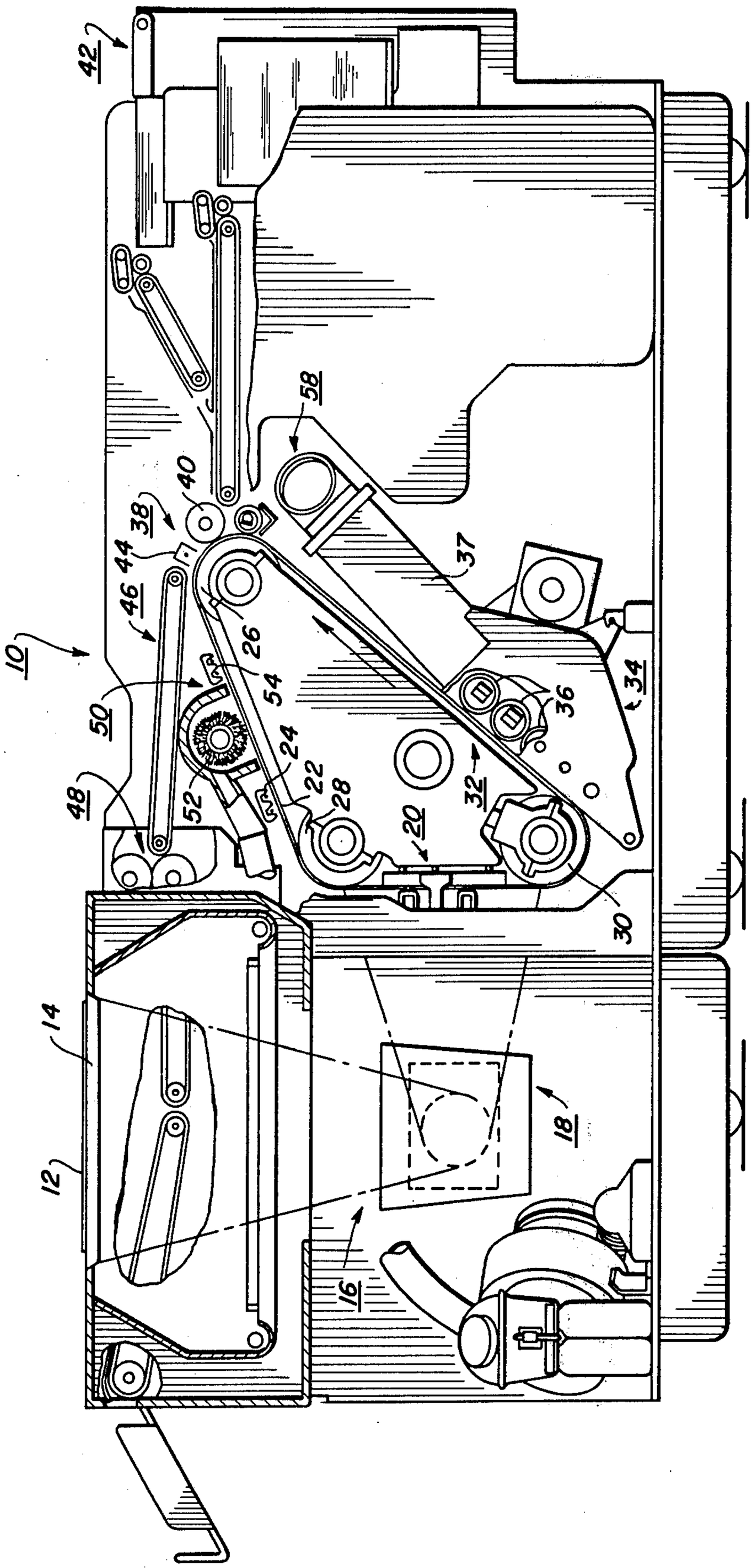

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FIG. 1

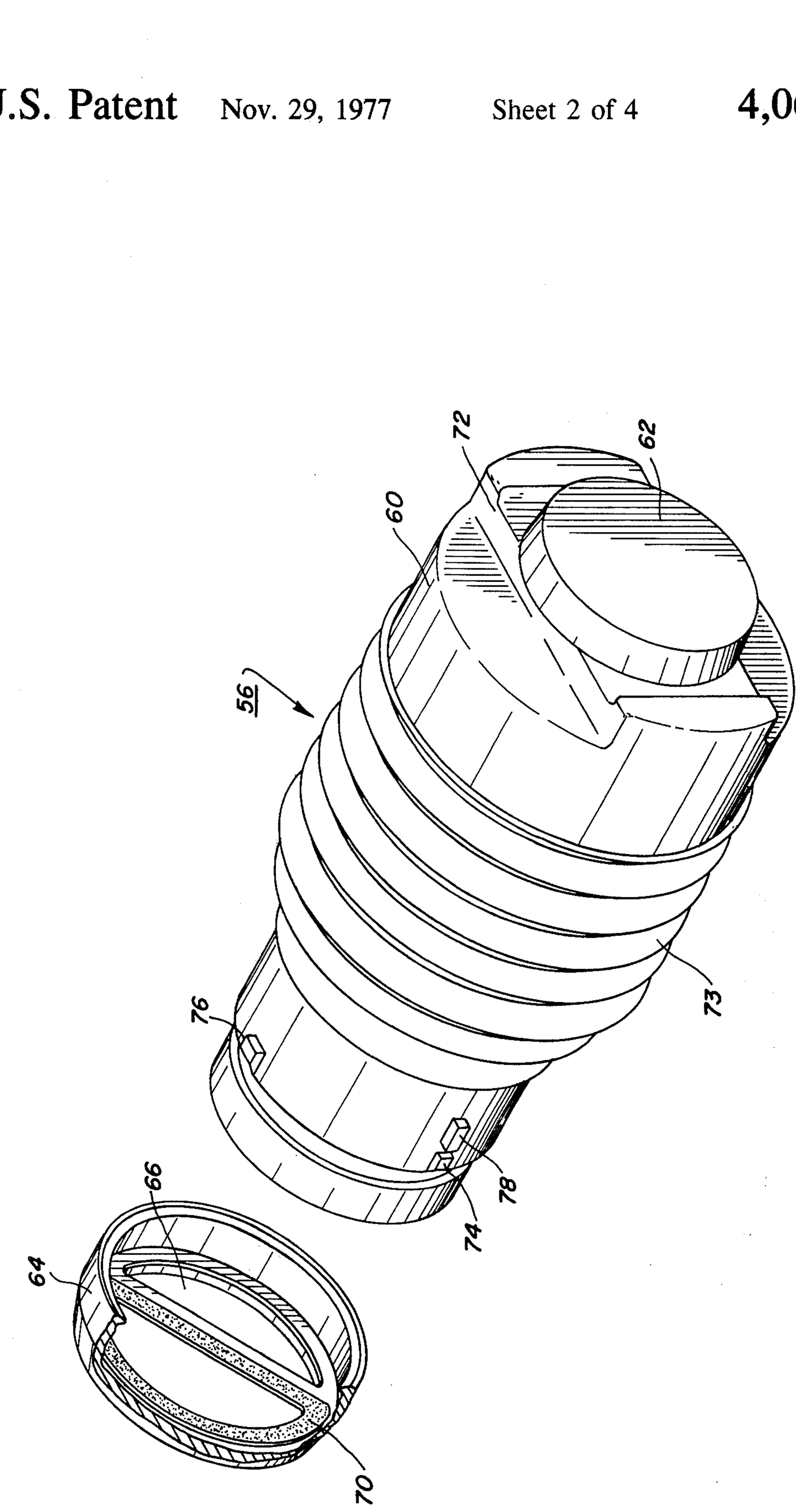

FIG. 2

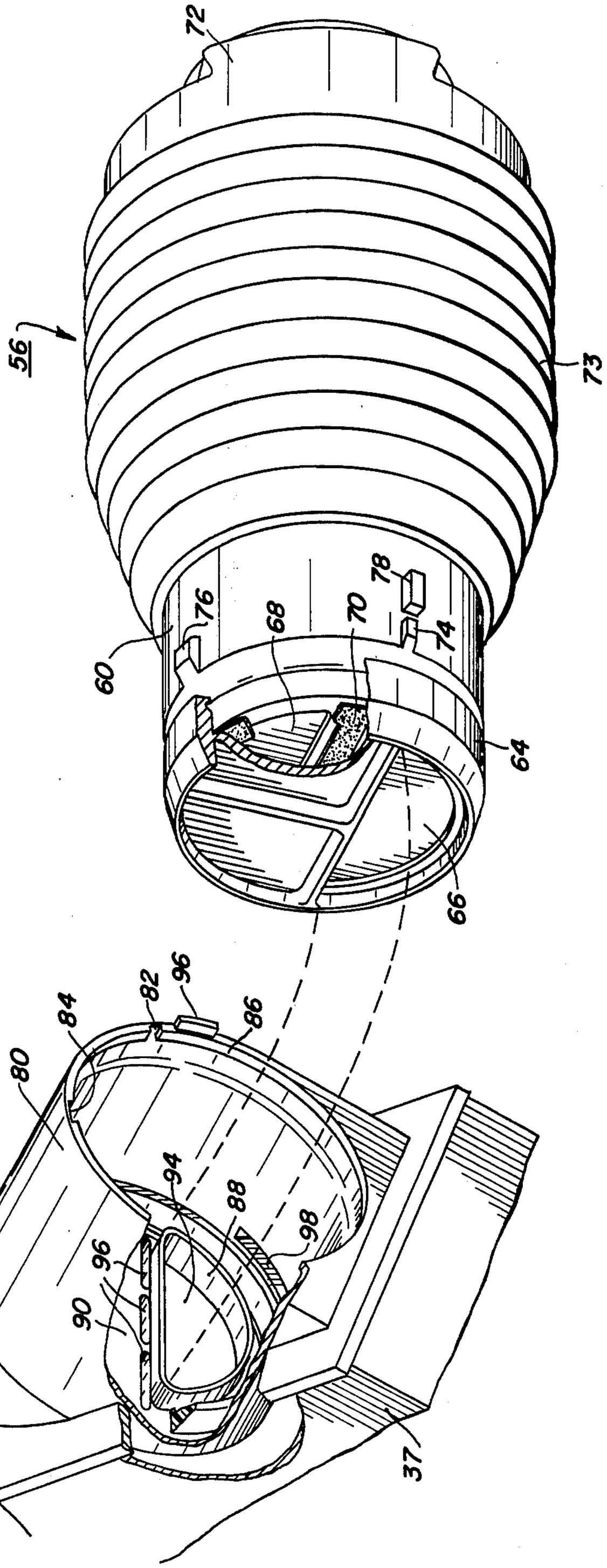

FIG. 3

FIG. 4

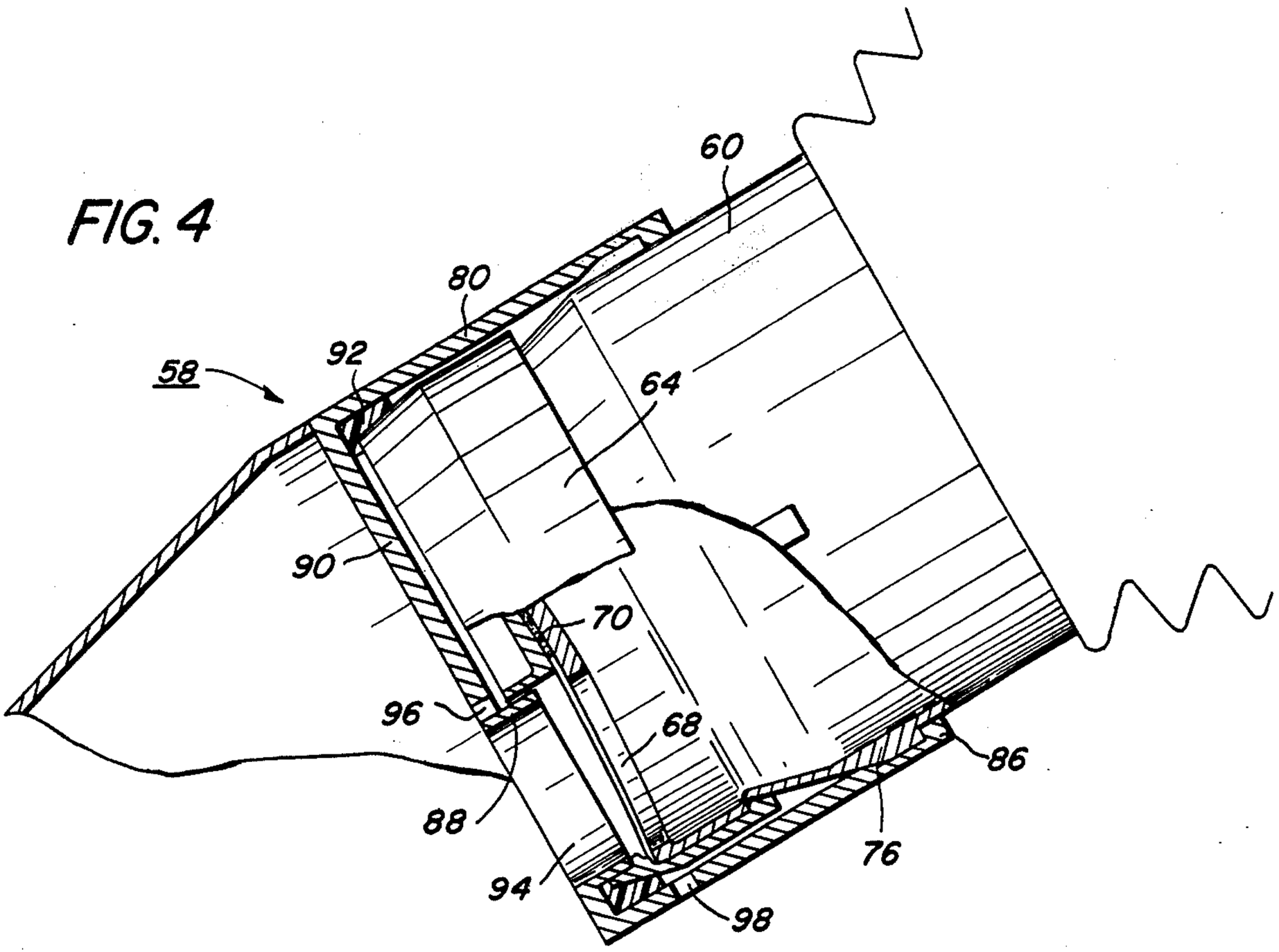
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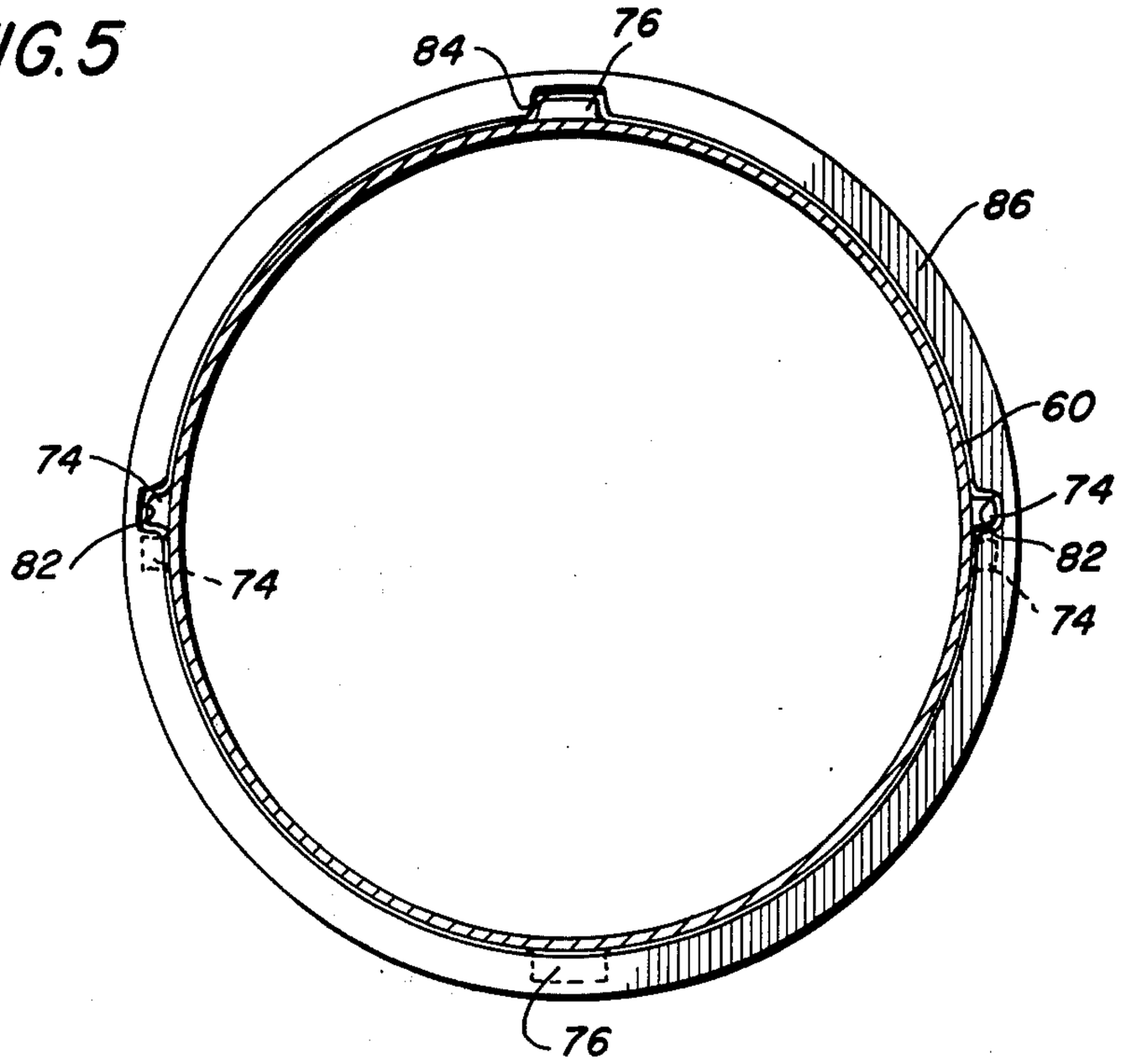
FIG. 5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TONER LOADING APPARATUS WITH REPLENISHING SUPPLY CONTAINER

This is a continuation, of application Ser. No. 612,529, filed Sept. 11, 1975.

BACKGROUND OF THE INVENTION

This invention relates to apparatus for and a method of adding toner to the toner hopper of an electrostatic reproduction machine.

In conventional xerography, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support electrostatic latent images. In the process, the xerographic surface is electrostatically charged, and the charged surface is then exposed to a light pattern of the image being reproduced to thereby discharge the surface in the areas where light strikes the surface. The undischarged areas of the surface thus form an electrostatic charge pattern (the latent image) conforming to the original pattern.

The latent image is then developed by contacting it with a finely divided electrostatically attractable powder referred to as toner. The toner is held on the image areas by the electrostatic charge on the photoconductive layer. Where the charge is greater, the greater amount of toner is deposited. Thus, a toner image is produced in conformity with a light image of the copy being reproduced. Generally, the developed image is then transferred to a suitable transfer member and affixed thereto to form a permanent record of the original document.

The latent image is developed by a suitable developer such as a magnetic brush developer. During the reproduction process, the toner in the developer is depleted. Thus, additional toner is periodically automatically dispensed into the developer by a toner hopper. Consequently, toner must also be added periodically to the toner hopper. Prior art arrangements for adding toner into a toner hopper require that toner be poured out of a container into the hopper; there are no connections between the container and the hopper. Toner is generally black and of small particle size. Unless extreme precaution is taken in pouring the toner, a cloud of fine toner is produced and toner is invariably deposited on the hands and clothing of the operator. This is highly undesirable because the powder is difficult to remove because of its small particle size. Also, in attempting to empty all of the toner from the toner container into the toner hopper, the operator may have to shake the toner container and/or tap the toner container against the toner hopper. This may result in spilling toner on the inside of the reproduction machine and in generating additional toner clouds, thus contaminating the interior of the reproduction machine.

Another prior art arrangement utilizes a toner bottle combined with a flexible conduit, the latter being connected to the toner bottle and to the toner hopper. The toner bottle is uprighted, and the toner passes through the conduit into the toner hopper. Like the above described arrangement this arrangement is also time consuming in that the toner bottle must still be shaken in attempting to empty all of its contents into the toner hopper. Also, if the hopper is filled before all of the contents of the toner bottle have been emptied, the operator is faced with the problem of disconnecting the conduit from the toner hopper without spilling toner within the machine. The toner contained within the conduit is almost invariably spilled on internal machine parts and/or the operator, thus producing the same contamination described above.

Thus, what is needed is an arrangement whereby toner can be quickly added to the toner hopper. The apparatus should be simple, easy to use, and should eliminate or minimize the danger of contaminating the inside of the reproduction machine or the operator.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an arrangement whereby toner can be easily and simply added to a toner hopper.

It is also an object of the present invention to provide a toner bottle whereby all, or essentially all, of the toner can be easily removed from the bottle, assuming that the toner hopper is capable of receiving all of the toner.

It is also an object of the present invention to eliminate or minimize the danger of contaminating the machine or the operator in the event the toner hopper is filled before all of the toner is emptied from the toner bottle.

The present invention includes a toner bottle having a body, the body having an outlet opening at one end thereof through which toner is added to a toner hopper of an electrostatic reproduction machine. The body is formed of resilient material, and has a portion in the form of a bellows. Rotatably mounted on one end of the body is a dispensing cap having an opening conforming generally in size and shape to the outlet opening, in the body. The dispensing cap can be rotated to an open position where its opening is aligned with the outlet opening, or to a closed position where its opening is moved out of alignment with the outlet opening. The bottle contains a plurality of locating lugs around it periphery, all of the lugs except one being the same size. Mounted on top of the toner hopper in the electrostatic reproduction machine is a receiver for receiving the bottle, the receiver having a neck which has a plurality of locating channels formed therein, the channels corresponding in number, location, and size to the locating lugs on the bottle. Consequently, the toner bottle can be inserted into the neck in only one position.

Mounted against a bottom wall at the inner end of the neck of the receiver is an annular seal against which the dispensing cap abuts when the toner bottle has been moved into the neck and locked therein by rotating the locating lugs out of alignment with the corresponding locating channels. Being closed when inserted into the neck, the bottle cannot be opened until the locating lugs are rotated out of alignment with their corresponding locating channels. A lip conforming generally in size and shape to the opening in the dispensing cap extends from the bottom wall, the lip surrounding an inlet opening through which toner enters the toner hopper. The lip mates with and extends into the opening in the cap whereby the latter is held in place while the body of the bottle is rotated to lock the bottle onto the hopper. Rotation of the body of the bottle is stopped when a stopping lug thereon abuts a stop on the neck; when this occurs the bottle is in its fully open position. Thus, once the bottle has been inserted into the neck and rotated to its fully open position, it cannot be removed from the neck until it has been moved to its fully closed position once again. After the bottle has been moved to its fully open position, the bellows is compressed several times to expel toner into the toner hopper. To fully close the

bottle and remove it from the neck, the body is rotated back to the position where the locating lugs are aligned with their corresponding locating channels. The toner bottle can now be removed from the neck without danger of spillage or contamination. A plurality of openings are formed in the neck and bottom wall of the receiver for permitting any excess toner to drain into the toner hopper upn removal of the toner bottle from the neck.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of an electrostatic reproduction machine embodying the principles of the present invention.

FIG. **2** is a perspective view of the toner bottle with the dispensing cap removed so that the seal mounted therein can be seen.

FIG. **3** is a perspective view of the toner bottle and the receiver.

FIG. **4** is a cross-sectional view taken through the neck of the receiver and the bottle showing the bottle locked into position in its fully open position.

FIG. **5** is a view showing the relationship of the locating lugs and their corresponding locating channels.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a general understanding of an electrostatic processing system in which the invention may be incorporated, reference is made to FIG. **1**. As in all electrostatic reproduction machines of the type illustrated, a light image of an original to be reproduced is projected onto the sensitized surface of a xerographic plate to form an electrostatic latent image thereon. Thereafter, the latent image is developed with an oppositely charged developing material comprising carrier beads and smaller toner particles triboelectrically adhering thereto to form a xerographic powder image corresponding to the latent image of the plate surface. The powder image is then electrostatically transferred to a support surface to which it may be fixed by a fusing device whereby the toner image is caused permanently to adhere to the support surface.

In the illustrated machine **10**, an original **12** to be copied is placed upon a transparent support platen **14** fixedly arranged in an illumination assembly generally indicated by the reference numeral **16**. While upon the platen, an illumination system flashes light rays upon the original, thereby producing image rays corresponding to the informational areas on the original. The image rays are projected by means of an optical system **18** to an exposure station **20** for exposing the photosensitive surface of a moving xerographic plate in the form of a flexible photoconductive belt **22**. In moving in the direction indicated by the arrow, prior to reaching the exposure station **20**, that portion of the belt being exposed would have been uniformly charged by a corona device **24** located at a belt run extending between belt supporting rollers **26** and **28**. The exposure station extends between the roller **28** and a third support roller **30**.

The exposure of the belt surface to the light image discharges the photoconductive layer in the areas struck by light, whereby a latent electrostatic image is produced on the belt in image configuration corresponding to the light image projected from the original on the supporting platen. As the belt surface continues its movement, the electrostatic image passes around the roller **30** and through the developing station **32** located at a third run of the belt in which there is positioned a developing apparatus or developer generally indicated by the reference numeral **34**. The developing apparatus **34** comprises a plurality of magnetic brushes **36** which carry developing material to the adjacent surface of the upwardly moving inclined photoconductive belt **22**. As the developing material is applied to the xerographic belt, toner particles in the development material are attracted electrostatically to the belt surface to form powder images. During the reproduction process, toner is periodically automatically dispensed into the developer **34** by a toner hopper **37** via any conventional means such as a foam roller.

The developed electrostatic image is transported by the belt **22** to a transfer station **38** located at a point of tangency on the belt as it moves around the roller **26** where a sheet of copy paper is moved in synchronism with the moving belt in order to accomplish transfer of the developed image. A transfer roller **40** at the transfer station is arranged on the frame of the machine to contact the non-transfer side of each sheet of copy paper as the latter is brought into transfer engagement with the belt **22**. The roller **40** is electrically biased with sufficient voltage so that a developed image on the belt may be electrostatically transferred to the adjacent side of a sheet of paper as the same is brought into contact therewith.

Also provided is a suitable sheet transport mechanism adapted to transport sheets of paper seriatim from a paper handling mechanism generally indicated by the reference numeral **42** to the developed image on the belt as the same is carried around the roller **26**. A programming device operatively connected to the mechanism **42**, and to the illumination device, is effective to present a developed image at the transfer station **38** in timed sequence with the arrival of a sheet of paper.

As the sheet emerges from the transfer roller, it is influenced by a detacking corona discharge device **44** so as to lessen the electrostatic attraction between the sheet and the belt. The sheet is thereafter retained on the underside of a transport mechanism **46** by suitable means such as vacuum for movement into a fuser assembly generally indicated by the reference numeral **48** wherein the developed and transferred xerographic powder image on the sheet is permanently affixed thereto. After fusing, the finished copy is discharged from the apparatus at a suitable point for the collection externally of the apparatus. The toner particles remaining as residue on the developed image, background particles, and those particles otherwise not transferred are carried by the belt **22** to a cleaning apparatus **50** positioned on the run of the belt between the rollers **26** and **28** adjacent to the charging device **24**. The cleaning apparatus comprises a rotating brush **52** and a corona discharge device **54**, for neutralizing charges remaining on the particles.

Referring now to FIGS. **2** and **3**, the apparatus for adding toner to the toner hopper **37** is illustrated. This apparatus includes a toner bottle **56** which is adapted to coact with a receiver **58** on top of the toner hopper **37**. The bottle **56** includes a one-piece blow-molded body **60** made of low density polyethylene, a removable filling cap **62**, and a dispensing cap **64** which is rotatably mounted on the dispensing end of the body. The dispensing cap **64** is a one piece injection molded member made of Acrylonitrile-Butadriene-Styrenene. As can be seen, the dispensing cap **64** has a D-shaped opening **66** which conforms generally in shape and size to a D-shaped outlet opening **68** in the end of the body **60**.

When the openings **66** and **68** are in the position shown in FIG. **3**, a seal **70** of polyethylene foam surrounds the outlet opening **68**, and the bottle is fully closed and sealed. When the body **60** is rotated 180° with respect to the dispensing cap **64** from the position shown in FIG. **2**, the two openings **66** and **68** will be in alignment and the bottle is fully open. At the filling end of the toner bottle **56**, the body is formed so as to produce a handle **72** with which to grasp the bottle while adding toner to the toner hopper **37**. The central portion of the body **60** is formed as a bellows **73**, the purpose of which will be explained hereafter. Near the dispensing end of the toner bottle **56** are two locating lugs **74** of identical size, and a third, but larger locating lug **76**. A stopping lug **78** is located immediately behind one of the locating lugs **74**.

To add toner to the hopper **37**, the bottle **56** is inserted into the neck **80** of the receiver **58** by aligning the locating lugs **74** with locating channels **82**, and the locating lug **76** with the locating channel **84**. Channels **82** and **84** are formed in an annular rim **86**, and respectively correspond in size and location to the locating lugs **74** and **76**. Thus, it can be seen that the bottle **56** can be inserted into the receiver **58** in only one position. The bottle **56** is then moved inwardly until the D-shaped lip **88** extending from a bottom wall **90** moves into the D-shaped opening **66** in the dispensing cap **64** and the end of the cap **64** abuts an annular rubber seal **92**. As can be seen, the D-shaped lip **88** surrounds a D-shaped inlet opening **94** in the bottom wall **90**, through which inlet opening toner is added to the toner hopper **37**. To lock the toner bottle **56** in abutting relation to the annular seal **92** and onto the toner hopper **37**, the body **60** is rotated 180° in a clockwise direction until the stopping lug **78** contacts a stop **96**. In this position, the bottle is fully opened, i.e., the openings **66** and **68** are aligned. During rotation of the body **60**, the dispensing cap **64** is held in a stationary position by the D-shaped lip **88**.

Toner is now expelled from the bottle **56** into the hopper **37** by grasping the handle **72**, pushing inwardly to compress the bellows **73**; and releasing the pressure to allow the bellows to expand. This procedure is repeated several times until all, or substantially all of the toner has been forced into the toner hopper **37**. The toner hopper has a suitable filtered opening (not shown) which allows the hopper to "breath", i.e., to permit air to be expelled when the bellows **73** is compressed, and to premit air to enter the hopper when the bellows is released; the filter prevents toner from being expelled from the hopper with the air. In addition to holding the dispensing cap **64** in a stationary position during rotation of the body **60**, the D-shaped lip **88** also serves to guide the toner from the bottle into the hopper. Tests have shown that more than 99% of the toner is consistently expelled from the bottle utilizing this apparatus. This assumes that the toner hopper **37** is able to receive all of the contents of the bottle **56**.

When the toner bottle **56** has been emptied, or when the toner hopper **37** has been filled and is incapable of accepting any more toner, the handle **72** is grasped and the body **60** is rotated in a counterclockwise direction until the locating lugs **74** and **76** are aligned with their corresponding locating channels **82** and **84** respectively. In this position the bottle is once again fully closed as shown in FIG. **3** and can be safely removed from the receiver **58**. Any minor amount of toner which may be present within the receiver **58** as the bottle is being withdrawn drains into the toner hopper **37** via openings **96** formed in the bottom wall **90** of the receiverand openings **98** formed in neck **80** of the receiver.

Thus, as can be seen, the bottle **56** is closed when inserted into the neck **80** of the receiver and cannot be opened until it is locked into place within the neck **80**. Conversely, the bottle cannot be removed from the neck **80** until the outlet opening **68** has been fully closed which corresponds to the position where the locating lugs **74** and **76** are in alignment with the locating channels **82** and **84**. The relative positions of the lugs are shown in FIG. **5**. The two smaller lugs **74** are located above the centerline which is perpendicular to the centerline running through the centerline of the larger lug. Thus, when the bottle is rotated 180°, the lugs will be in the position indicated by the dotted lines. Thus, the bottle can only be removed from the receiver when it has been fully closed; there is no possibility of the bottle being removed while still partially open.

It should also be noted (see FIG. **4**) that the D-shaped seal **70** located on the inner convex surface of the dispensing cap **64** serves to provide a very efficient seal. This seal surrounds the D-shaped outlet opening **68** in the toner bottle when the bottle is closed thus preventing any toner from escaping from the bottle. When the body **60** is rotated with respect to the dispensing cap **64**, however, very little torque is required to rotate the bottle since there is a constant gap between the inner surface of the dispensing cap **64** and the end surface of the bottle.

Thus, as stated above, the present invention provides for a "white glove" operation, i.e., it permits an operator to add toner to a toner hopper without contaminating either the operator or internal machine parts. In addition, the bottle **56** can only be inserted into the receiver **58** in one position and cannot be removed from the receiver until the bottle has been fully closed. Conversely, the bottle cannot be opened after insertion until it has been locked into place within the receiver **58**. Thus, there is no danger of spilling toner on internal machine parts. Also in the event that the toner hopper is filled before the toner bottle **56** has been emptied, no damage is done; the toner bottle must be closed before it can be removed from the neck **80** of the receiver **58**, and any excess powder within the neck will drain through the openings **96** and **98** into the toner hopper **37** since the neck is inclined downwardly.

While the invention has been described with reference to the structure disclosed, it is not confined to the details set forth, but is intended to cover such modifications or changes as may come within the scope of the following claims.

What is claimed is:

1. Improved apparatus for adding toner to a toner hopper in an electrostatic reproduction machine wherein the improvement comprises:

a. a toner bottle including a body and a cap, the body having one end with an opening formed therein, the cap having an opening formed therein, and means for rotatably mounting the cap onto the one end of the body so that the opening in the cap can be rotated into and out of general alignment with the opening in the body;

b. means defining an inlet opening through which toner can be added to the hopper, the inlet opening conforming generally in size and shape to the opening in the one end of the body;

c. a lip surrounding the inlet opening and conforming generally in size and shape to both the inlet opening

and the opening in the cap, the lip being adapted to mate with the opening in the cap to hold the latter in a stationary position while the body is rotated to bring the opening in the body into general alignment with both the opening in the cap and the inlet opening; and

d. means for stopping the rotation of the body when all of the openings are generally aligned.

2. Improved apparatus according to claim **1**, and further including means for simultaneously locking the bottle onto the hopper as the body is being rotated to bring the opening in the latter into general alignment with the opening in the cap, and for preventing the bottle from being removed from the hopper until the latter openings have been moved out of alignment.

3. Improved apparatus according to claim **2**, wherein at least a portion of the body is formed of resilient material as a bellows which can be compressed to expel toner from the bottle.

4. Improved apparatus according to claim **3**, which includes:

1. an annular neck surrounding and extending outwardly from the inlet opening, the inner diameter of the neck being approximately the same dimension as the outer diameter of the cap, and
2. means for draining any excess toner remaining around the inlet opening within the neck into the hopper.

5. An improved method for adding toner to a toner hopper in an electrostatic reproduction machine by moving the tone from a toner bottle through an outlet opening in one end of the toner bottle and through an inlet opening in the toner hopper, wherein the improvement comprises the steps of:

a. positioning the one end of the bottle in a predetermined position over the inlet opening in the hopper;

b. rotating a portion of the bottle to simultaneously open the outlet opening and lock the bottle onto the hopper;

c. stopping the rotation of the bottle portion when the openings are aligned and the outlet opening is completely opened by rotating the bottle portion until a lug on the bottle portion contacts a lug on the toner hopper; and

d. compressing the bottle to expel toner through the aligned openings.

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